WHAT IS CLAIMED IS:

1. A frequency converter to which an input signal, a local oscillation signal and a reference direct current signal are supplied, the frequency converter comprising:

a variable gain amplifier which amplifies the local oscillation signal according to a gain control signal and outputs an amplified local signal;

an even harmonic mixer which is supplied with the input signal and the amplified local oscillation signal and outputs an output signal whose frequency is a sum of a first frequency of the input signal and a second frequency of two or more even numbered times a frequency of the amplified local oscillation signal or a difference between the first frequency and the second frequency;

an amplitude detector which is supplied with the amplified local oscillation signal and outputs a direct current signal having an amplitude corresponding to an amplitude of the amplified local oscillation signal; and

a comparator which compares the direct current signal of the amplitude detector with the reference direct current signal to generate an output signal as the gain control signal.

2. A frequency converter according to claim 1, wherein the even harmonic mixer includes differential

transistor pairs each having a pair of transistors.

3. A frequency converter according to claim 2, wherein the reference direct current signal corresponds to a first reference direct current signal, the even harmonic mixer is constructed by a first even harmonic mixer, and the amplitude detector is constructed by a second even harmonic mixer having the same circuit configuration as the first even harmonic mixer, and supplied with a second reference direct current signal.

4. A frequency converter according to claim 1, wherein the even harmonic mixer includes four differential bipolar transistor pairs each having a pair of bipolar transistors.

5. A frequency converter according to claim 4, wherein the reference direct current signal corresponds to a first reference direct current signal, the even harmonic mixer is constructed by a first even harmonic mixer, and the amplitude detector is constructed by a second even harmonic mixer having the same circuit configuration as the first even harmonic mixer, and supplied with a second reference direct current signal.

6. A frequency converter according to claim 1, wherein the even harmonic mixer includes four differential field effect transistor pairs each having a pair of field effect transistors.

7. A frequency converter according to claim 6, wherein the reference direct current signal corresponds

to a first reference direct current signal, the even harmonic mixer is constructed by a first even harmonic mixer, and the amplitude detector is constructed by a second even harmonic mixer having the same circuit configuration as the first even harmonic mixer, and supplied with a second reference direct current signal.

8. A frequency converter according to claim 7, wherein the second even harmonic mixer is supplied with a variable reference direct current signal as the reference direct current signal to adjust a conversion gain of the second even harmonic mixer.

9. A frequency converter according to claim 7, wherein the first even harmonic mixer and the second even harmonic mixer each include a variable bias unit configured to vary a bias state of the even harmonic mixer.

10. A frequency converter according to claim 1, wherein the even harmonic mixer is supplied with a variable reference direct current signal as the reference direct current signal to adjust a conversion gain of the even harmonic mixer.

11. A frequency converter according to claim 1, wherein the reference direct current signal is a first reference direct current signal, the even harmonic mixer is constructed by a first even harmonic mixer, and the amplitude detector is constructed by a second even harmonic mixer having the same circuit

configuration as the first even harmonic mixer, and supplied with a second reference direct current signal.

12. An orthogonal demodulator using an input signal, a first local oscillation signal, a second local oscillation signal, a first reference signal, and a second reference signal, the orthogonal demodulator comprising:

a first frequency converter including:

a first variable gain amplifier which amplifies the first local oscillation signal according to a first gain control signal, and outputs an amplified first local oscillation signal;

a first even harmonic mixer which is supplied with the input signal and the amplified first local oscillation signal and outputs an output signal whose frequency corresponds to a difference between a frequency of the input signal and a frequency of two or more even numbered times a frequency of the amplified first local oscillation signal;

a first amplitude detector which is supplied with the amplified first local oscillation signal and outputs a first direct current signal having an amplitude corresponding to an amplitude of the amplified first local oscillation signal; and

a first comparator which compares the first reference direct current signal with the first direct current signal to generate an output signal as

the first gain control signal;

a second frequency converter including:

a second variable gain amplifier which amplifies the second local oscillation signal according to a second gain control signal, and outputs an amplified second local oscillation signal;

a second even harmonic mixer which is supplied with the input signal and the amplified second local oscillation signal and outputs an output signal whose frequency corresponds to a difference between a frequency of the input signal and a frequency of two or more even numbered times a frequency of the amplified second local oscillation signal;

a second amplitude detector which is supplied with the amplified second local oscillation signal and outputs a second direct current signal having an amplitude corresponding to an amplitude of the amplified second local oscillation signal; and

a second comparator which compares the second reference direct current signal with the second direct current signal to generate an output signal as the second gain control signal; and

a phase shifter which outputs the first local oscillation signal and the second local oscillation signal with a given phase difference therebetween to the first frequency converter and the second frequency converter.

13. An orthogonal demodulator according to claim 12, wherein the phase difference is 90°/n, when the frequency of the input signal is n times the frequency of the first local oscillation signal and the second local oscillation signal, where n is two or more even number.

14. An orthogonal modulator using an input signal, a first local oscillation signal, a second local oscillation signal, a first reference signal, and a second reference signal, the orthogonal demodulator comprising:

a first frequency converter including:

a first variable gain amplifier which amplifies the first local oscillation signal according to a first gain control signal, and outputs an amplified first local oscillation signal;

a first even harmonic mixer which is supplied with the I signal of baseband and the amplified first local oscillation signal and outputs an output signal whose frequency corresponds to a sum of a frequency of the input signal and a frequency of two or more even numbered times a frequency of the amplified first local oscillation signal;

a first amplitude detector which is supplied with the amplified first local oscillation signal and outputs a first direct current signal having an amplitude corresponding to an amplitude of

the amplified first local oscillation signal; and

a first comparator which compares the first reference direct current signal with the first direct current signal to generate an output signal as the first gain control signal;

a second frequency converter including:

a second variable gain amplifier which amplifies the second local oscillation signal according to a second gain control signal, and outputs an amplified second local oscillation signal;

a second even harmonic mixer which is supplied with the Q signal of baseband and the amplified second local oscillation signal and outputs an output signal whose frequency corresponds to a sum of a frequency of the Q signal and a frequency of two or more even numbered times a frequency of the amplified second local oscillation signal;

a second amplitude detector which is supplied with the amplified second local oscillation signal and outputs a first direct current signal having an amplitude corresponding to an amplitude of the amplified first local oscillation signal; and

a second comparator which compares the second reference direct current signal with the second direct current signal to generate an output signal as the second gain control signal; and

a phase shifter which outputs the first local

oscillation signal and the second local oscillation signal with a given phase difference therebetween to the first frequency converter and the second frequency converter.

15. An orthogonal modulator according to claim 14, wherein the phase difference is 90°/n, when the frequency of the input signal is n times the frequency of the first local oscillation signal and the second local oscillation signal, where n is two or more even number.

16. A receiver comprising:

the frequency converter according to claim 10;

a received signal state detector configured to detect a received signal state and output a detection signal; and

a controller supplied with the detection signal and configured to output a control signal used for setting a conversion gain and an operation state to the frequency converter.

17. A receiver comprising:

the frequency converter according to claim 11;

a received signal state detector configured to detect a received signal state and output a detection signal; and

a controller supplied with the detection signal and configured to output a control signal used for setting a conversion gain and an operation state to

the frequency converter.

18. A receiver comprising:

the frequency converter according to claim 12;

a received signal state detector configured to detect a received signal state and output a detection signal; and

a controller supplied with the detection signal and configured to output a control signal used for setting a conversion gain and an operation state to the frequency converter.